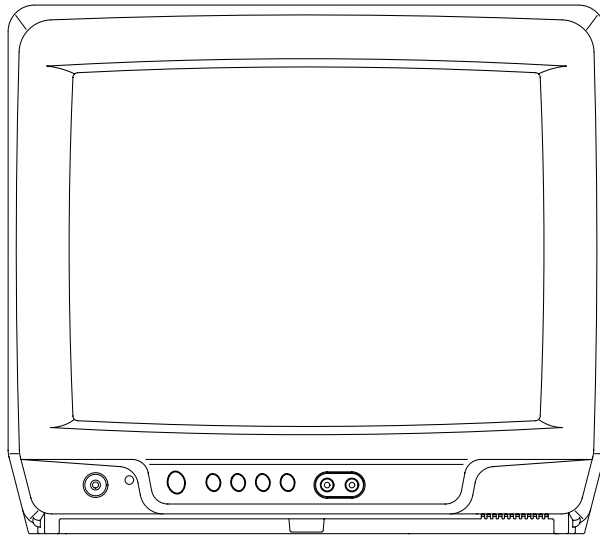


# Service Manual

Color Television

Main Manual



**Panasonic**

Models	Chassis
CT-13R18B	TMC573
CT-13R38S	TMC573
CT-13R28W	TMC573

This service manual is issued as a service guide for the models listed above. Included in this manual are a set of schematic, block diagrams, functional descriptions, alignment procedures, disassembly procedures and a complete parts list.

**WARNING!** This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this Main Manual.


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# Important Safety Notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol  and printed in **BOLD TYPE** on the replacement part list. It is essential that these critical parts are replaced with the manufacturer's specified replacement part to prevent X-ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

## Safety Precautions

### General Guidelines

An **Isolation Transformer** should always be used during the servicing of a receiver whose chassis is not isolated from AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the Receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

**Always Replace Protective Devices**, such as fishpaper, isolation resistors and capacitors, and shields after servicing the Receiver. Use only manufacturer's recommended rating for fuses, circuits breakers, etc. High potentials are present when this Receiver is operating. Operation of the Receiver without the rear cover introduces danger for electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high-voltage equipment.

**Extreme care** should be practiced when **Handling the Picture Tube**. Rough handling may cause it to implode due to atmospheric pressure. (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe. Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to X-ray radiation.

The **Test Picture Tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provide shielding for the tube viewing area against X-ray radiation as well as implosion. The magnetic shield limits the X-ray radiation around the bell of the picture tube in addition to the restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling **50kV** without causing X-ray radiation.

**Before returning a serviced receiver to the owner**, the service technician must thoroughly test the unit to ensure that is completely safe to operate. **Do not use a line isolation transformer when testing.**

### Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and expose metallic parts such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240k $\Omega$  and 5.2M $\Omega$ . If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

### Leakage Current Hot Check (Fig. 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

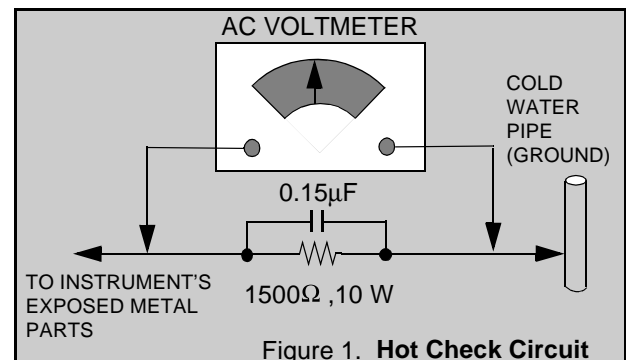
Connect a 1.5k $\Omega$  10 watt resistor in parallel with a 0.15 $\mu$ F capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS.

A leakage current tester (such a Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 0.5 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the Receiver must be repaired and rechecked before it is returned to the customer.



### X-ray Radiation

**WARNING:** The potential source of X-ray radiation in the TV set is in the High Voltage section and the picture

**Note:** It is important to use an accurate, calibrated high voltage meter.

Set the **brightness and picture** controls to Minimum. Measure the High Voltage. The high voltage should be **24.5  $\pm$  1.0kV**. If the upper limit is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

# Service Notes

**Note: These components are affixed with glue. Be careful not to break or damage any foil under the component or at the pins of the ICs when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the component loose.**

## Leadless Chip Component (surface mount)

Chip components must be replaced with identical chips due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chips capacitor or resistor board solder pads may have holes through the board, however the hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor may also be limited for the same reason. It is recommended that identical components be used.

Chip resistor have a three digit numerical resistance code - 1st and 2nd significant digits and a multiplier.

Example: 162 = 1600 or 1.6kΩ resistor, 0 = 0Ω (jumper).

Chip capacitors generally do not have the value indicated on the capacitor. The color of the component indicates the general range of the capacitance.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor.

Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

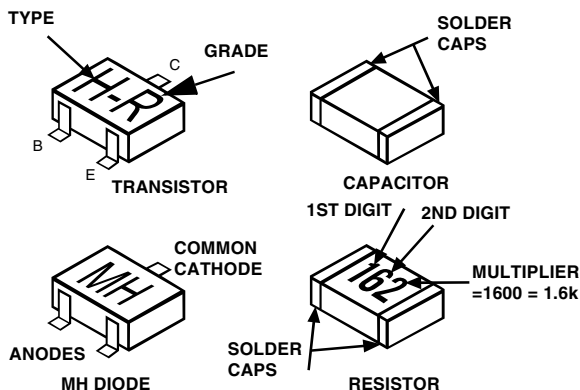
## Component Removal

1. Use solder wick to remove solder from component end caps or terminal.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

## Chip Component Installation

1. Put a small amount of solder on the board soldering pads.
2. Hold the chip component against the soldering pads with tweezers or with a miniature alligator clip and apply heat to the pad area with a 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.

### Chip Components

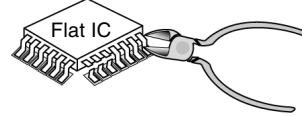


## How to Replace Flat-IC

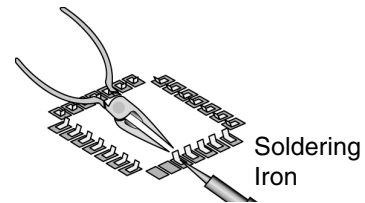
### - Required Tools -

- Soldering iron
- Needle nose pliers
- Wire cutters (sharp & small)
- De-solder braids
- Magnifier

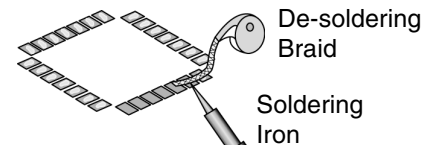
1. Cut the pins of a defective IC with wire cutters. Remove IC from board. If IC is glued to the board, heat the IC and release the IC. See Note above.



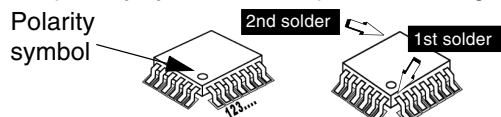
2. Using soldering iron and needle nose pliers remove the IC pins from the board.



3. Using de-soldering braid and soldering iron remove solder from affected area on board (pads).

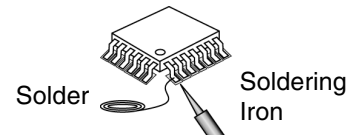


4. Position the new Flat-IC in place (apply the pins of the Flat-IC to the soldering pads where the pins need to be soldered). Determine the positions of the soldering pads and pins by correctly aligning the polarity symbol. Solder pin #1 first, align the IC.

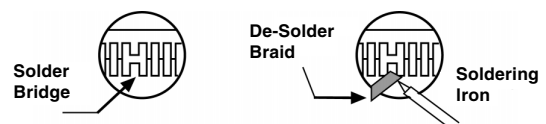


Solder the pin opposite to pin #1. This will assist positioning the IC.

5. Solder all pins to the soldering pads using a fine tipped soldering iron.



6. Check with a magnifier for solder bridge between the pins or for dry joint between pins and soldering pads. To remove a solder bridge, use a de-solder braid as shown in the figure below.



## Service Notes (Continued)

**IMPORTANT:** To protect against possible damage to the solid state devices due to arcing or static discharge, make certain that all ground wires and CTR DAG wire are securely connected.

**CAUTION:** The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing the Receiver to avoid damage to the test equipment or to the chassis. Connect the test equipment to the proper ground (  $\nabla$  ) or (  $\nearrow$  ) when servicing, or incorrect voltages will be measured.

**WARNING:** This Receiver has been designed to meet or exceed applicable safety and X-ray radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to X-ray radiation and shock and fire hazard, parts indicated with the symbol  $\triangle$  on the schematic must be replaced with identical parts. Order parts from the manufacturer's parts center using the parts numbers shown in this service manual, or provide the chassis number and the part reference number.

For optimum performance and reliability, all other parts should be replaced with components of identical specification.


# About lead free solder (PbF)

**Note:** Lead is listed as (Pb) in the periodic table of elements.

In the information below, Pb will refer to Lead solder, and PbF will refer to Lead Free Solder.

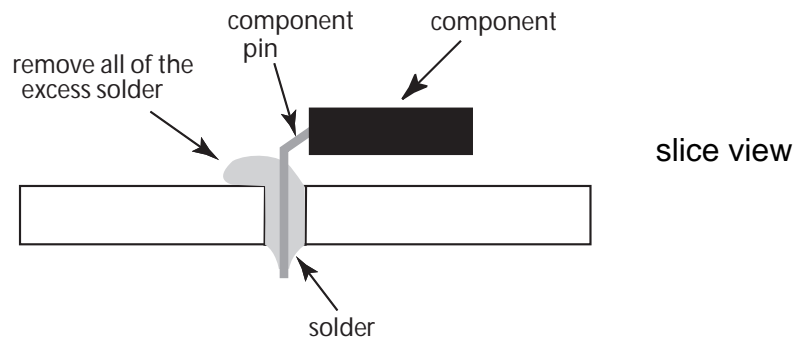
The Lead Free Solder used in our manufacturing process and discussed below is Sn(Tin)+Ag(Silver)

This model uses Pb Free solder in it's manufacture due to environmental conservation issues.

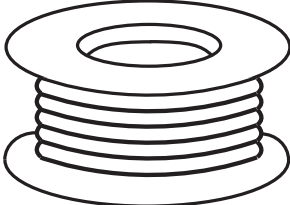
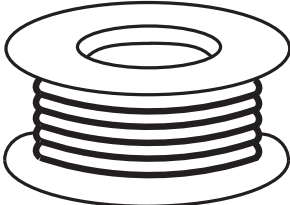
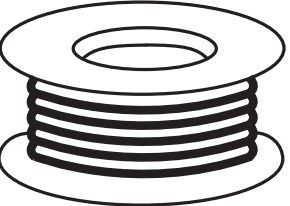
PCBs manufactured using lead free solder will have the PbF within a leaf Symbol  stamped on the front of PCB.

## Caution

- Pb free solder has a higher melting point than standard solder. Typically the melting point is 30 ~ 40 °C higher. Please use a high temperature soldering iron and set it to  $350 \pm 5^{\circ}\text{C}$ .
- Pb free solder will tend to splash when heated too high (about 1100 °F or 600 °C). If you must use Pb solder, please completely remove all of the Pb free solder on the pins or solder area before applying Pb solder. If this is not practical, be sure to heat the Pb free solder until it melts, before applying Pb solder.
- After applying PbF solder to double layered boards, please check the component side for excess solder which may flow onto the opposite side. (see figure below)



## Suggested Pb free solder

0.3mm X 100g	0.6mm X 100g	1.0mm X 100g
		

## GENERAL SPECIFICATIONS

G-1	TV System	CRT	CRT Size / Visual Size	13 inch / 335.4mm
			CRT Type	Normal
			Deflection	90 degree
			Magnetic Field BV/BH	+0.45G/0.18G
			Color System	NTSC
			Speaker	1 Speaker
			Position	Front
			Size	1.5 x 2.5 Inch
			Impedance	8 ohm
			Sound Output	MAX 1.0 W 10%(Typical) 0.8 W
			NTSC3.58+4.43 /PAL60Hz	No
G-2	Tuning System	Broadcasting System		US System M
		Tuner and Receive CH	System	1 Tuner
			Destination	USA(W/ CATV)
			Tuning System	F-Synth
			Input Impedance	VHF/UHF 75 ohm
			CH Coverage	2 - 69, 4A, A-5 - A-1, A - I, J - W, W+1 - W+84
		Intermediate Frequency	Picture(FP)	45.75MHz
			Sound(FS)	41.25MHz
			FP-FS	4.50MHz
			Preset CH	No
			Stereo/Dual TV Sound	No
	Tuner Sound Muting	Yes		
G-3	Power	Power Source	AC	120V AC 60Hz
			DC	-
		Power Consumption		at AC
			Stand by (at AC)	54 W at AC 120 V 60 Hz
			Per Year	3 W at AC 120 V 60 Hz -- kWh/Year
	Protector	Power Fuse	Yes	
G-4	Regulation	Safety		UL
		Radiation		FCC
		X-Radiation		DHHS
G-5	Temperature	Operation		0oC ~ +40oC
		Storage		-20oC ~ +60oC
G-6	Operating Humidity			Less than 80% RH

## GENERAL SPECIFICATIONS

<b>G-7</b>	<b>On Screen Display</b>	Menu	Menu Type	Yes		
			Picture	Picture(Matsusita Type)		
			Contrast(Picture)	Yes		
			Brightness	Yes		
			Color	Yes		
			Tint	Yes		
			Sharpness	Yes		
			Normal	Yes		
			Audio	No		
			Bass	No		
			Treble	No		
			Balance	No		
			BBE On/Off	No		
			Stable Sound On/Off	No		
			SET UP	Yes		
			Language	Yes		
			Mode	Yes		
			Auto Program	Yes		
			Manual Program	Yes		
			CC	Yes		
			Timer	Yes		
			Lock	Yes		
			Exit	Yes		
			CH Label	No		
			Favorite CH	No		
			Color Stream DVD/DTV	No		
			Control Level	Yes		
			Sound	Yes		
			Brightness	Yes		
			Contrast(Picture)	Yes		
			Color	Yes		
			Tint	Yes		
			Sharpness	Yes		
Tuning	No					
Bass	No					
Treble	No					
Balance	No					
Back Light	No					
Stereo,Audio Output,SAP	No					
Video(Aux)	Yes					
Color Stream	No					
Channel(TV/Cable)	Yes					
CH Label	No					
Sound Mute	Yes					
V-chip Rating	Yes					
<b>G-8</b>	<b>OSD Language</b>		English	French	Spanish	
<b>G-9</b>	<b>Clock and Timer</b>	Sleep Timer	Max Time	120 Min		
			Step	10 Min		
		On/Off Timer	Program(On Tim / Off Tim)	No		
		Wake Up Timer		No		
		Timer Back-up (at Power Off Mode)	more than	--	Min Sec	



## GENERAL SPECIFICATIONS

G-10	Remote Control	Unit	RC-GP	
		Glow in Dark Remocon	No	
		Format	KASEIKYO	
		Custom Code	08-00 h	
		Power Source	Voltage(D.C) UM size x pcs	3V UM-3(AA) x 2 pcs
		Total Keys		20 Keys
		Keys	Power	Yes
			1	Yes
			2	Yes
			3	Yes
			4	Yes
			5	Yes
			6	Yes
			7	Yes
			8	Yes
			9	Yes
			0	Yes
			100	No
			CH Up(UP)	Yes
			CH Down(DOWN)	Yes
			Volume Up(Right)	Yes
			Volume Down(Left)	Yes
			TV/Caption/Text	No
			CH1/CH2	No
			TV/Video(TV/AV)	Yes
			CH RTN/CH ENT(Quick View)	Yes
			Sleep	No
			RE Call(Call)	Yes
			Reset	No
			Menu	No
			Enter	No
			Mute	Yes
			Action	Yes
	Exit	No		
	MTS(Audio Select)	No		
	Set +	No		
	Set -	No		
G-11	Features	Auto Degauss	Yes	
		Auto Shut Off	Yes	
		CATV	Yes	
		Anti-theft	No	
		Rental	No	
		Memory(Last CH)	Yes	
		Memory(Last Volume)	Yes	
		V-Chip	Yes	
		Type	USA,ORION Type	
		BBE	No	
		Auto Search	No	
		CH Allocation	No	
		SAP	No	
		Just Clock Function	No	
		CH Label	No	
		VM Circuit	No	
		Full OSD	No	
		Premiere	No	
		Comb Filter	No	
			Lines	
		Auto CH Memory	Yes	
		Hotel Lock	No	
		Closed Caption	Yes	
		Stable Sound	No	
		FBT Leak Test Protect	Yes	
		CH Lock	No	
		Video Lock	No	
		Game Timer	No	
		Power On Memory	Yes	
		Energy Star	Yes(Buyer's Responsibility)	
		Favorite CH	No	

## GENERAL SPECIFICATIONS

<b>G-12</b>	<b>Accessories</b>	Owner's Manual	Language	English/Spanish	
			W/ Warranty	Yes	
		Remote Control Unit		Yes	
		Rod Antenna		Yes	
			Poles	1Poles	
			Terminal		
		Loop Antenna		No	
			Terminal	-	
		U/V Mixer		No	
		DC Car Cord (Center+)		No	
		Warranty Card		No	
		Warning Sheet		No	
		Circuit Diagram		No	
		Antenna Change Plug		No	
		Service Facility List		No	
		Important Safety Instruction		No	
		Dew/AHC Caution Sheet		No	
		AC Plug Adapter		No	
		Quick Set-up Sheet		No	
		Battery		Yes	
	UM size x pcs	UM3(AA) x 2			
	OEM Brand	Yes			
AC Cord		No			
AV Cord (2Pin-1Pin)		No			
Registration Card (NDL Card)		No			
ESP Card		No			
PTB Sheet		No			
300 ohm to 75 ohm Antenna Adapter		No			
<b>G-13</b>	<b>Interface</b>	Switch	Front	Power	Yes
				System Select	No
				Main Power SW	No
				Sub Power	No
				CH Up(UP)	Yes
				CH Down(DOWN)	Yes
				Volume Up(Right)	Yes
				Volume Down(Left)	Yes
				ACTION=Volume Up+Volume Down	Yes
				Rear	AC/DC
		TV/CATV Selector	No		
		Degauss	No		
		Main Power SW	No		
		Indicator	Power	No	
			Stand-by	No	
			On Timer	No	
		Terminals	Front	Video Input	RCA
				Audio Input	RCA x 1
				Other Terminal	Ear Phone
			Rear	Video Input(Rear1)	No
				Video Input(Rear2)	No
				Audio Input(Rear1)	No
				Audio Input(Rear2)	No
				Video Output	No
				Audio Output	No
				Euro Scart	No
				Color Stream	No
				Diversity	No
				Ext Speaker	No
				DC Jack 12V(Center +)	No
VHF/UHF Antenna Input	F Type				
AC Outlet	No				
<b>G-14</b>	<b>Set Size</b>	Approx. W x D x H (mm)	359.4 x 354 x 337		
<b>G-15</b>	<b>Weight</b>	Net (Approx.)	9.5 kg (20.9 lbs)		
		Gross (Approx.)	11.0kg (24.4lbs)		
<b>G-16</b>	<b>Carton</b>	Master Carton		No	
			Content	--- Sets	
			Material	-- /--	
			Dimensions W x D x H(mm)	-- x -- x --	
			Description of Origin	No	
		Gift Box		Yes	
			Material	Double/White	
			Dimensions W x D x H(mm)	440 x 408 x 396	
		Drop Test	Design	As per Buyer's	
			Description of Origin	Yes	
				Natural Dropping At 1 Corner / 3 Edges / 6 Surfaces	
			Height (cm)	62	
Container Stuffing		725 Sets/40' container			

## GENERAL SPECIFICATIONS

<b>G-17</b>	<b>Material</b>	Cabinet	Cabinet Front	PS 94V0 DECABROM
			Cabinet Rear	PS 94V0 DECABROM
		PCB	Non-Halogen Demand	No
			Eyelet Demand	Yes
<b>G-18</b>	<b>Environment</b>	Pb Free	Lead-free Solder	Yes
		Cd Free		No

# DISASSEMBLY INSTRUCTIONS

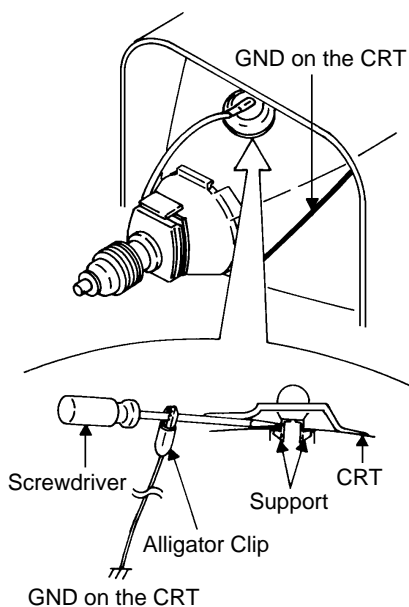
## 1. REMOVAL OF ANODE CAP

Read the following **NOTED** items before starting work.

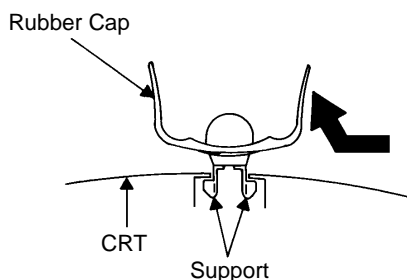
- \* After turning the power off there might still be a potential voltage that is very dangerous. When removing the Anode Cap, make sure to discharge the Anode Cap's potential voltage.
- \* Do not use pliers to loosen or tighten the Anode Cap terminal, this may cause the spring to be damaged.

### REMOVAL

1. Follow the steps as follows to discharge the Anode Cap. Connect one end of an Alligator Clip to the metal part of a flat-blade screwdriver and the other end to ground. While holding the plastic part of the insulated Screwdriver, touch the support of the Anode with the tip of the Screwdriver. A cracking noise will be heard as the voltage is discharged.



2. Flip up the sides of the Rubber Cap in the direction of the arrow and remove one side of the support.



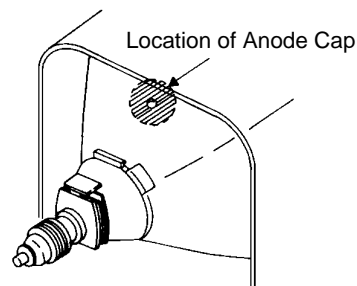
3. After one side is removed, pull in the opposite direction to remove the other.

### NOTE

Take care not to damage the Rubber Cap.

## INSTALLATION

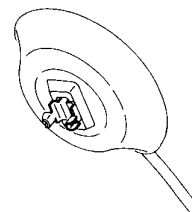
1. Clean the spot where the cap was located with a small amount of alcohol.



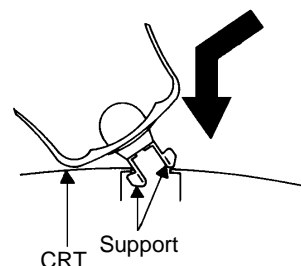
### NOTE

Confirm that there is no dirt, dust, etc. at the spot where the cap was located.

2. Arrange the wire of the Anode Cap and make sure the wire is not twisted.
3. Turn over the Rubber Cap.



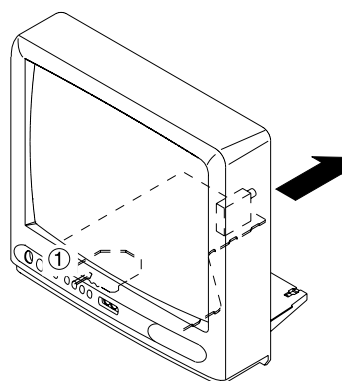
4. Insert one end of the Anode Support into the anode button, then the other as shown in the figure below.



5. Confirm that the Support is securely connected.
6. Put on the Rubber Cap without moving any parts.

## 2. NOTE FOR THE REMOVAL OF THE MAIN PCB

When the removal of the Main PCB, remove the hook ① first, then draw it in the direction of the arrow.



## SERVICE MODE LIST

This unit provided with the following SERVICE MODES so you can repair, examine and adjust easily.  
To enter the Service Mode, press both set key and remote control key for more than 1 second.

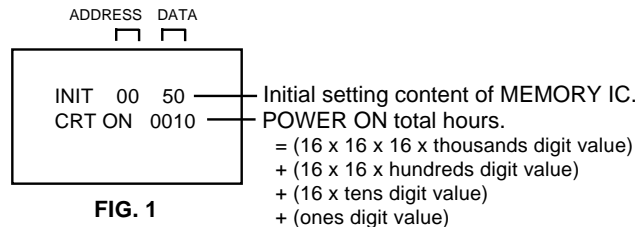
Set Key	Remocon Key	Operations
VOL. (-) MIN	0	Releasing of V-CHIP PASSWORD.
VOL. (-) MIN	1	User Reset. NOTE: If you set a factory initialization, the memories are reset such as the channel setting, and the POWER ON total hours.
VOL. (-) MIN	3	Remocon code selection. NOTE: If you perform the remocon code selection, the remocon cannot be used. So, do not select the remocon code for the normal servicing.
VOL. (-) MIN	6	POWER ON total hours is displayed on the screen. Refer to the "CONFIRMATION OF HOURS USED".  Can be checked of the INITIAL DATA of MEMORY IC. Refer to the "WHEN REPLACING EEPROM (MEMORY) IC".
VOL. (-) MIN	9	Display of the Adjustment MENU on the screen. Refer to the "ELECTRICAL ADJUSTMENT" (On-Screen Display Adjustment).

## CONFIRMATION OF HOURS USED

POWER ON total hours can be checked on the screen. Total hours are displayed in 16 system of notation.

**NOTE: If you set a factory initialization, the total hours is reset to "0".**

1. Set the VOLUME to minimum.
2. Press both VOL. DOWN button on the set and Channel button (6) on the remote control for more than 1 second.
3. After the confirmation of using hours, turn off the power.



## WHEN REPLACING EEPROM (MEMORY) IC

If a service repair is undertaken where it has been required to change the MEMORY IC, the following steps should be taken to ensure correct data settings while making reference to TABLE 1.

**NOTE: No need setting for after INI 0F due to the adjustment value.**

INI	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
00	50	04	FB	4C	46	B3	24	69	39	30	00	05	90	D4	00	07

**Table 1**

1. Enter DATA SET mode by setting VOLUME to minimum.
2. Press both VOL. DOWN button on the set and Channel button (6) on the remote control for more than 1 second. ADDRESS and DATA should appear as FIG 1.
3. ADDRESS is now selected and should "blink". Using the CH. UP/DOWN button on the remote, step through the ADDRESS until required ADDRESS to be changed is reached.
4. Press VOL. UP/DOWN button to select DATA. When DATA is selected, it will "blink".
5. Again, step through the DATA using VOL. UP/DOWN button until required DATA value has been selected.
6. Pressing CH. UP/DOWN button will take you back to ADDRESS for further selection if necessary.
7. Repeat steps 3 to 6 until all data has been checked.
8. When satisfied correct DATA has been entered, turn POWER off (return to STANDBY MODE) to finish DATA input.  
**After the data input, do the User Reset.**
9. Turn POWER on.
10. Press both VOL. DOWN button on the set and Channel button (1) on the remote control for more than 1 second.
11. After the finishing of the initializing of shipping, the unit will turn off automatically.  
The unit will now have the correct DATA for the new MEMORY IC.

<b>Service mode default values</b>		
NO.	FUNCTION	STEP NO.
00	OSD H	19
01	CUT OFF	---
04	H.VCO	4
05	H.PHASE	11
06	V.SIZE	35
07	V.SHIFT	1
08	R.DRIVE	10
09	B.DRIVE	10
10	R.BIAS	64
11	G.BIAS	64
12	B.BIAS	64
13	BRIGHT CENT	120
14	BRIGHT MAX	140
15	BRIGHT MIN	60
16	CONTRAST CENT	30
17	CONTRAST MAX	45
18	CONTRAST MIN	17
19	COLOR CENT	50
20	COLOR MAX	74
21	COLOR MIN	0
22	TINT	47
23	SHARPNESS	40
28	TEST MONO	0

# ELECTRICAL ADJUSTMENTS

## 1. BEFORE MAKING ELECTRICAL ADJUSTMENTS

Read and perform these adjustments when repairing the circuits or replacing electrical parts or PCB assemblies.

### CAUTION

- Use an isolation transformer when performing any service on this chassis.
- Before removing the anode cap, discharge electricity because it contains high voltage.
- When removing a PCB or related component, after unfastening or changing a wire, be sure to put the wire back in its original position.
- When you exchange IC and Transistor for a heat sink, apply the silicon grease (**YG6260M**) on the contact section of the heat sink. Before applying new silicon grease, remove all the old silicon grease. (Old grease may cause damages to the IC and Transistor.)
- **The adjustments are needed for each mode, RF mode and AV mode. Perform the adjustments referring each adjustment items.**

Prepare the following measurement tools for electrical adjustments.

1. Oscilloscope
2. Digital Voltmeter
3. Pattern Generator

### On-Screen Display Adjustment

1. In the condition of NO indication on the screen. Press the VOL. DOWN button on the set and the Channel button (**9**) on the remote control for more than 1 second to appear the adjustment mode on the screen as shown in **Fig. 1-1**.

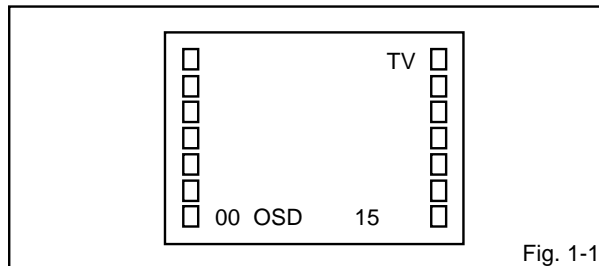


Fig. 1-1

2. Use the Channel UP/DOWN button or Channel button (**0-9**) on the remote control to select the options shown in **Fig. 1-2**.
3. Press the ACTION button on the remote control to end the adjustments.

NO.	FUNCTION	NO.	FUNCTION
00	OSD H	14	BRIGHT MAX
01	CUT OFF	15	BRIGHT MIN
04	H.VCO	16	CONTRAST CENT
05	H.PHASE	17	CONTRAST MAX
06	V.SIZE	18	CONTRAST MIN
07	V.SHIFT	19	COLOR CENT
08	R.DRIVE	20	COLOR MAX
09	B.DRIVE	21	COLOR MIN
10	R.BIAS	22	TINT
11	G.BIAS	23	SHARPNESS
12	B.BIAS	28	TEST MONO
13	BRIGHT CENT		

Fig. 1-2

## 2. BASIC ADJUSTMENTS

### 2-1: CUT OFF (RF)

1. Adjust the unit to the following settings.  
R.DRIVE=10, B.DRIVE=10, R.BIAS=64, G.BIAS=64, B.BIAS=64, BRIGHTNESS=120, CONTRAST=40.
2. Place the set with Aging Test for more than 15 minutes.
3. Activate the adjustment mode display of **Fig. 1-1** and press the channel button (**01**) on the remote control to select "CUT OFF".
4. Adjust the **Screen Volume** until a dim raster is obtained.

### 2-2: WHITE BALANCE (RF)

**NOTE:** Adjust after performing CUT OFF adjustment.

1. Place the set with Aging Test for more than 10 minutes.
2. Receive the gray scale pattern from the Pattern Generator.
3. Using the remote control, set the brightness and contrast to normal position.
4. Activate the adjustment mode display of **Fig. 1-1** and press the channel button (**10**) on the remote control to select "R. BIAS".
5. Press the CH. UP/DOWN button on the remote control to select the "R. BIAS", "G. BIAS", "B. BIAS", "R. DRIVE" or "B. DRIVE".
6. Adjust the VOL. UP/DOWN button on the remote control to whiten the R. BIAS, G. BIAS, B. BIAS, R. DRIVE, and B. DRIVE at each step tone sections equally.
7. Perform the above adjustments 5 and 6 until the white color is looked like a white.

### 2-3: FOCUS (RF)

1. Receive a broadcast.
2. Turn the Focus Volume fully counterclockwise once.
3. Adjust the **Focus Volume** until picture is distinct.

### 2-4: HORIZONTAL PHASE (RF)

1. Receive the center cross signal from the Pattern Generator.
2. Activate the adjustment mode display of **Fig. 1-1** and press the channel button (**05**) on the remote control to select "H.PHAS".
3. Press the VOL. UP/DOWN button on the remote control until the right and left screen size of the vertical line becomes the same.

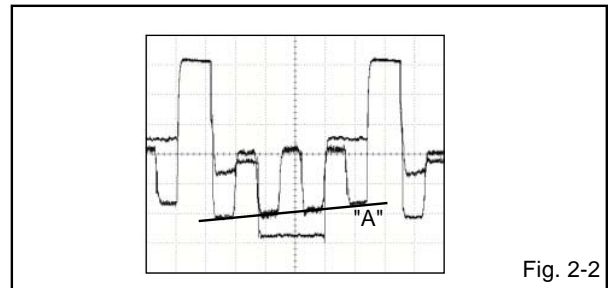
### 2-5: VERTICAL SIZE (RF)

1. Receive the cross hatch signal from the Pattern Generator.
2. Using the adjustment control, set the brightness and contrast to normal position.
3. Activate the adjustment mode display of **Fig. 1-1** and press the channel button (**06**) on the remote control to select "V.SIZE".
4. Press the VOL. UP/DOWN button on the remote control until the rectangle on the center of the screen becomes square.
5. Receive a broadcast and check if the picture is normal.

# ELECTRICAL ADJUSTMENTS

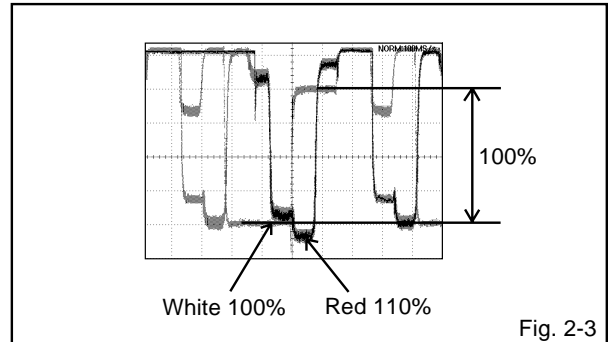
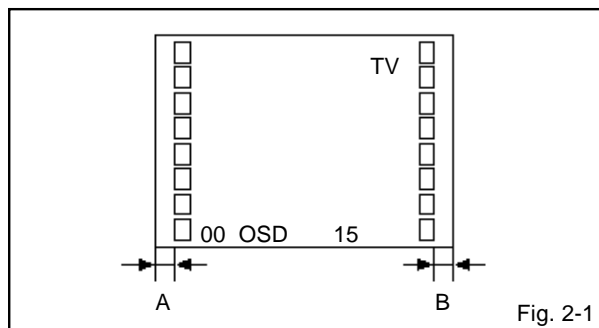
## 2-6: VERTICAL SHIFT (RF)

1. Receive the center cross signal from the Pattern Generator.
2. Activate the adjustment mode display of **Fig. 1-1** and press the channel button **(07)** on the remote control to select "V.SFT".
3. Press the VOL. UP/DOWN button on the remote control until the horizontal line becomes fit to the notch of the shadow mask.



## 2-7: OSD HORIZONTAL (RF)

1. Activate the adjustment mode display of **Fig. 1-1**.
2. Press the VOL. UP/DOWN button on the remote control until the difference of A and B becomes minimum. (**Refer to Fig. 2-1**)



## 2-8: BRIGHTNESS MANUAL (RF, AV)

1. Activate the adjustment mode display of **Fig. 1-1** and press the channel button **(13)** on the remote control to select "BRI.CENT".
2. Press the VOL. UP/DOWN button on the remote control until the brightness step No. becomes "120".
3. Receive a broadcast and check if the picture is normal.
4. Press the TV/VIDEO button on the remote to set to the AV mode. Then perform the above adjustment 2-3.

## 2-9: SUB TINT/SUB COLOR (RF, AV)

1. Receive the color bar pattern. (RF Input)
2. Activate the adjustment mode display of **Fig. 1-1** and press the channel button **(22)** on the remote control to select "TINT".
3. Connect the oscilloscope to **TP023**.
4. Press the VOL. UP/DOWN button on the remote control until the section "A" becomes as straight line. (**Refer to Fig. 2-2**)
5. Press the channel button **(19)** on the remote control to select "COL. CENT".
6. Connect the oscilloscope to **TP022**.
7. Adjust the VOLTS RANGE VARIABLE knob of the oscilloscope until the range between white 100% and 0% is set to 5 scales on the screen of the oscilloscope.
8. Press the VOL. UP/DOWN button on the remote control until the red color level is adjusted to 110% of the white level. (**Refer to Fig. 2-3**)
9. Receive the color bar pattern. (Audio Video Input)
10. Press the TV/VIDEO button on the remote control to set to the AV mode. Then perform the above adjustments 2-8.

## 2-10: SUB CONTRAST (RF, AV)

1. Activate the adjustment mode display of **Fig. 1-1** and press the channel button **(17)** on the remote control to select "CONT.MAX".
2. Press the VOL. UP/DOWN button on the remote control until the contrast step No. becomes "45".
3. Receive a broadcast and check if the picture is normal.
4. Press the TV/VIDEO button on the remote to set to the AV mode. Then perform the above adjustment 2-3.



# ELECTRICAL ADJUSTMENTS

## 3. PURITY AND CONVERGENCE ADJUSTMENTS

### NOTE

1. Turn the unit on and let it warm up for at least 30 minutes before performing the following adjustments.
2. Place the CRT surface facing east or west to reduce the terrestrial magnetism.
3. Turn ON the unit and demagnetize with a Degauss Coil.

### 3-1: STATIC CONVERGENCE (ROUGH ADJUSTMENT)

1. Tighten the screw for the magnet. Refer to the adjusted CRT for the position. **(Refer to Fig. 3-1)**  
If the deflection yoke and magnet are in one body, untighten the screw for the body.
2. Receive the green raster pattern from the color bar generator.
3. Slide the deflection yoke until it touches the funnel side of the CRT.
4. Adjust center of screen to green, with red and blue on the sides, using the pair of purity magnets.
5. Switch the color bar generator from the green raster pattern to the crosshatch pattern.
6. Combine red and blue of the 3 color crosshatch pattern on the center of the screen by adjusting the pair of 4 pole magnets.
7. Combine red/blue (magenta) and green by adjusting the pair of 6 pole magnets.
8. Adjust the crosshatch pattern to change to white by repeating steps 6 and 7.

### 3-2: PURITY

#### NOTE

Adjust after performing adjustments in section 3-1.

1. Receive the green raster pattern from color bar generator.
2. Adjust the pair of purity magnets to center the color on the screen.  
Adjust the pair of purity magnets so the color at the ends are equally wide.
3. Move the deflection yoke backward (to neck side) slowly, and stop it at the position when the whole screen is green.
4. Confirm red and blue color.
5. Adjust the slant of the deflection yoke while watching the screen, then tighten the fixing screw.

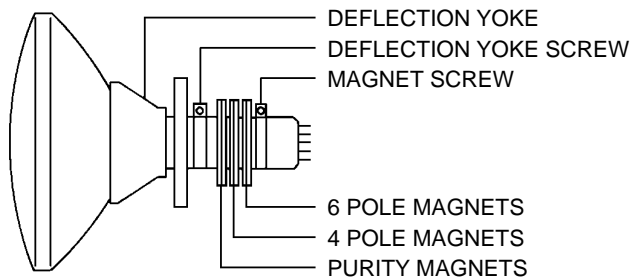


Fig. 3-1

### 3-3: STATIC CONVERGENCE

#### NOTE

Adjust after performing adjustments in section 3-2.

1. Receive the crosshatch pattern from the color bar generator.
2. Combine red and blue of the 3 color crosshatch pattern on the center of the screen by adjusting the pair of 4 pole magnets.
3. Combine red/blue (magenta) and green by adjusting the pair of 6 pole magnets.

### 3-4: DYNAMIC CONVERGENCE

#### NOTE

Adjust after performing adjustments in section 3-3.

1. Adjust the differences around the screen by moving the deflection yoke upward/downward and right/left. **(Refer to Fig. 3-2-a)**
2. Insert three wedges between the deflection yoke and CRT funnel to fix the deflection yoke. **(Refer to Fig. 3-2-b)**

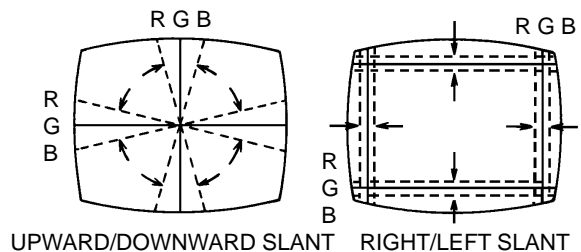
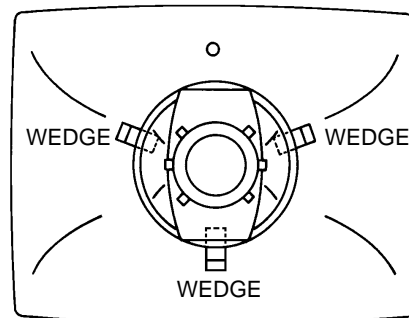


Fig. 3-2-a

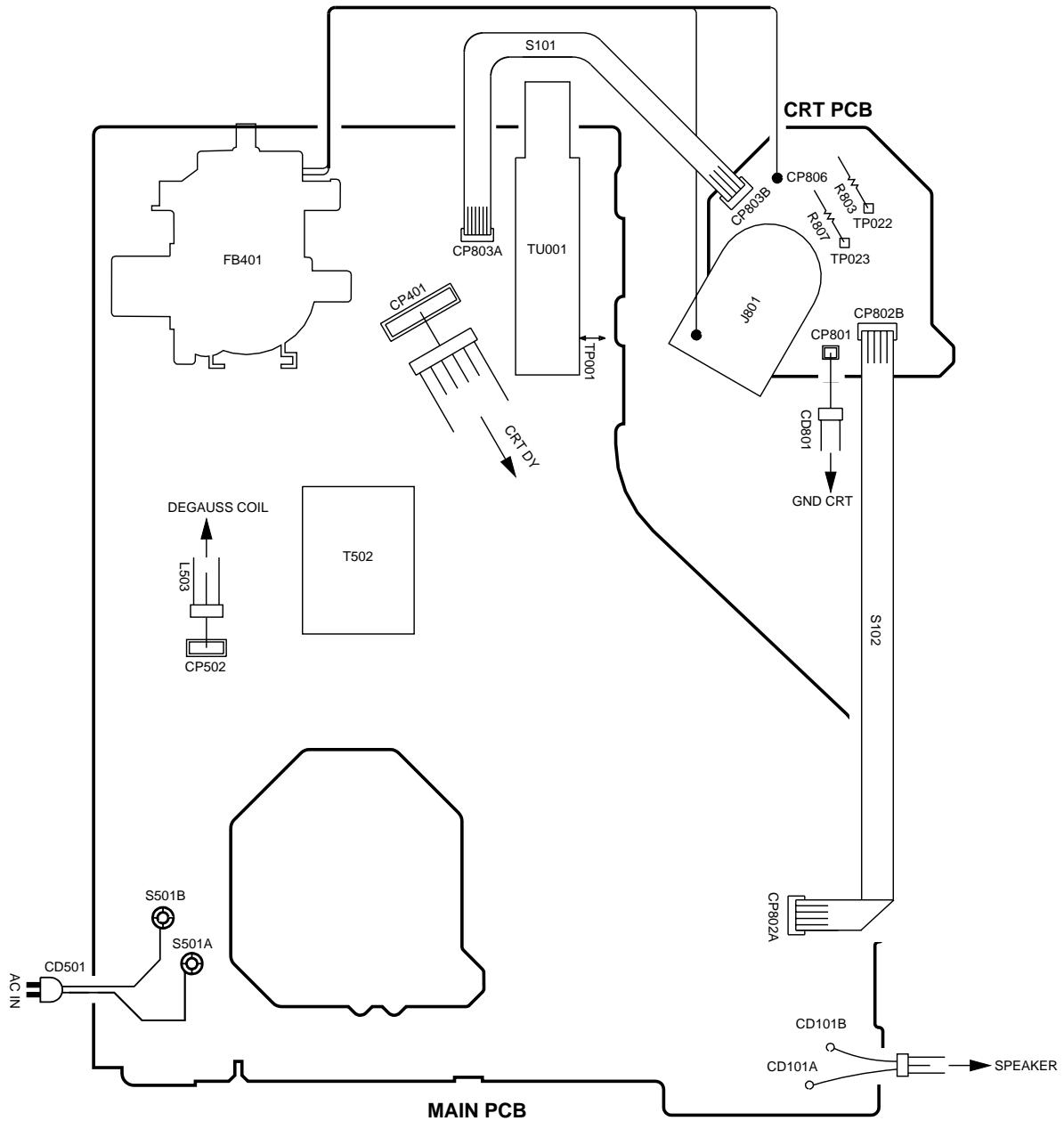


WEDGE POSITION

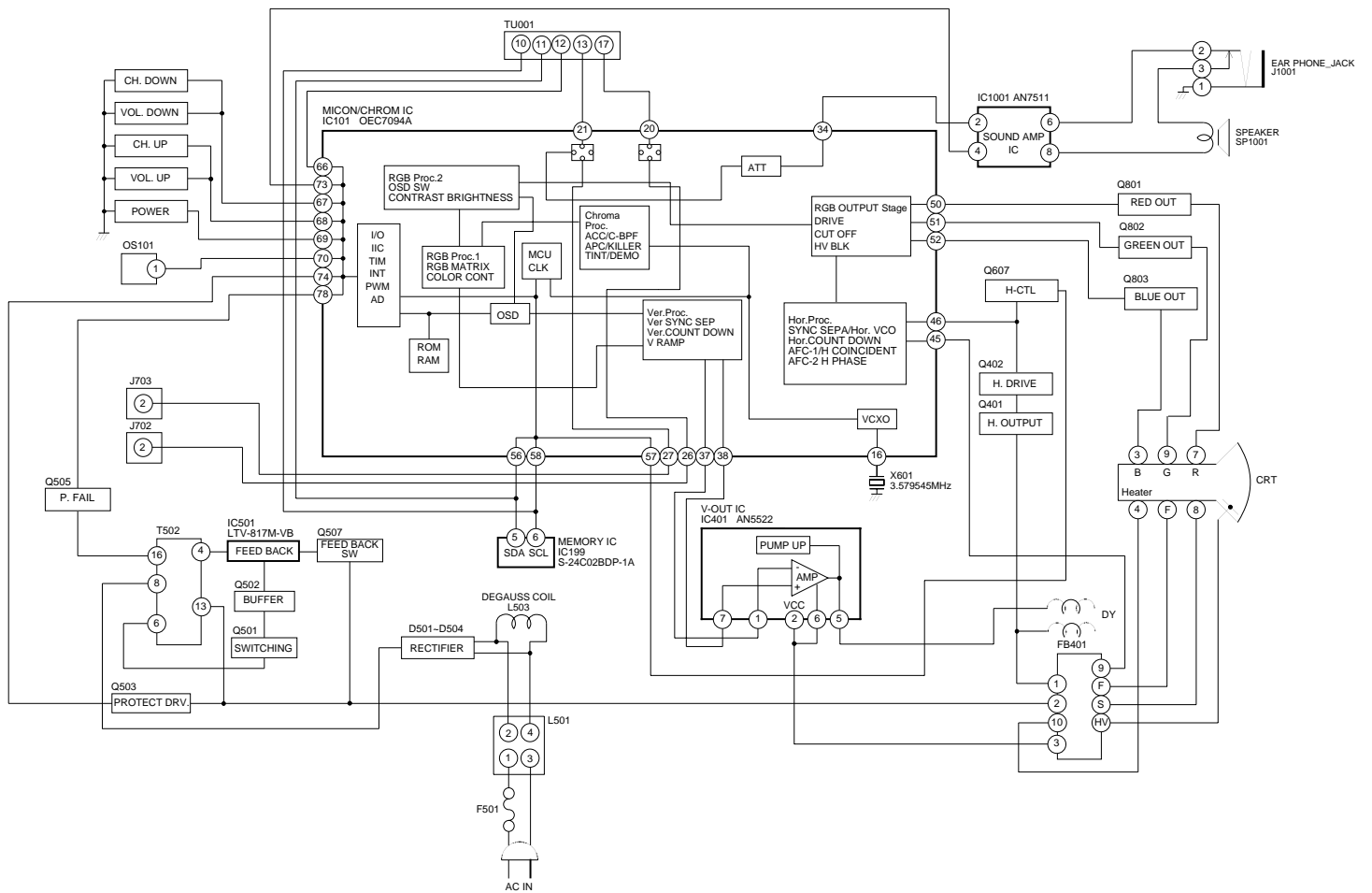
Fig. 3-2-b

# ELECTRICAL ADJUSTMENTS

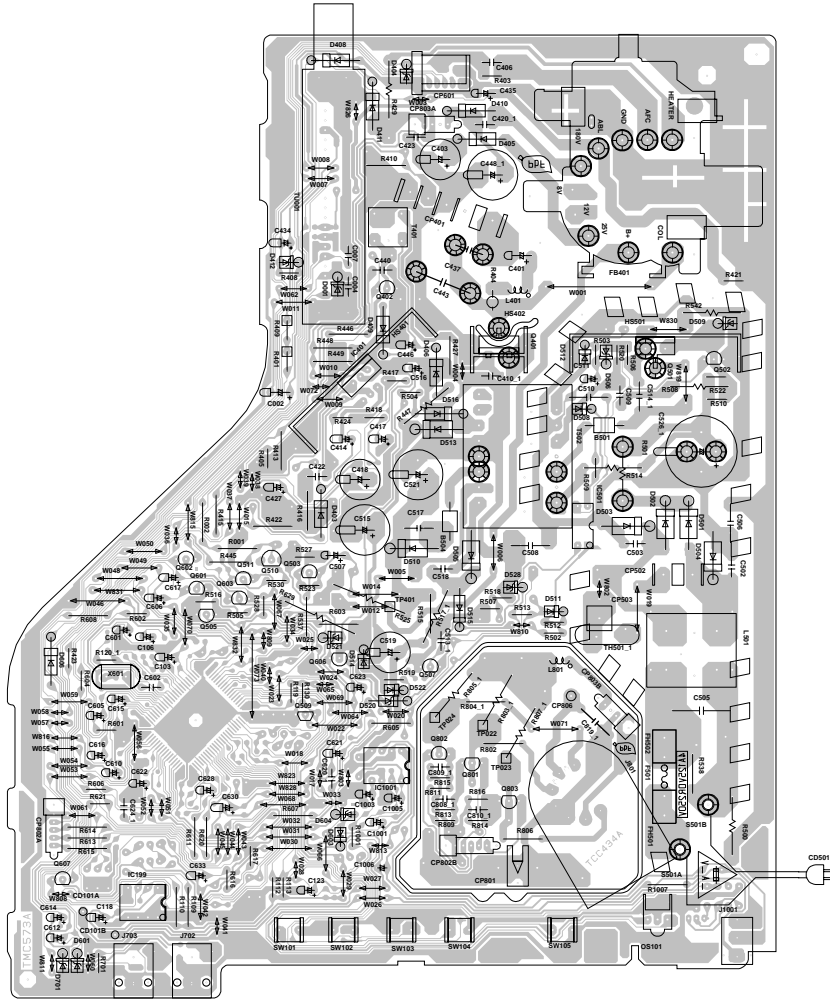
## 4. ELECTRICAL ADJUSTMENT PARTS LOCATION GUIDE (WIRING CONNECTION)



### BLOCK DIAGRAM

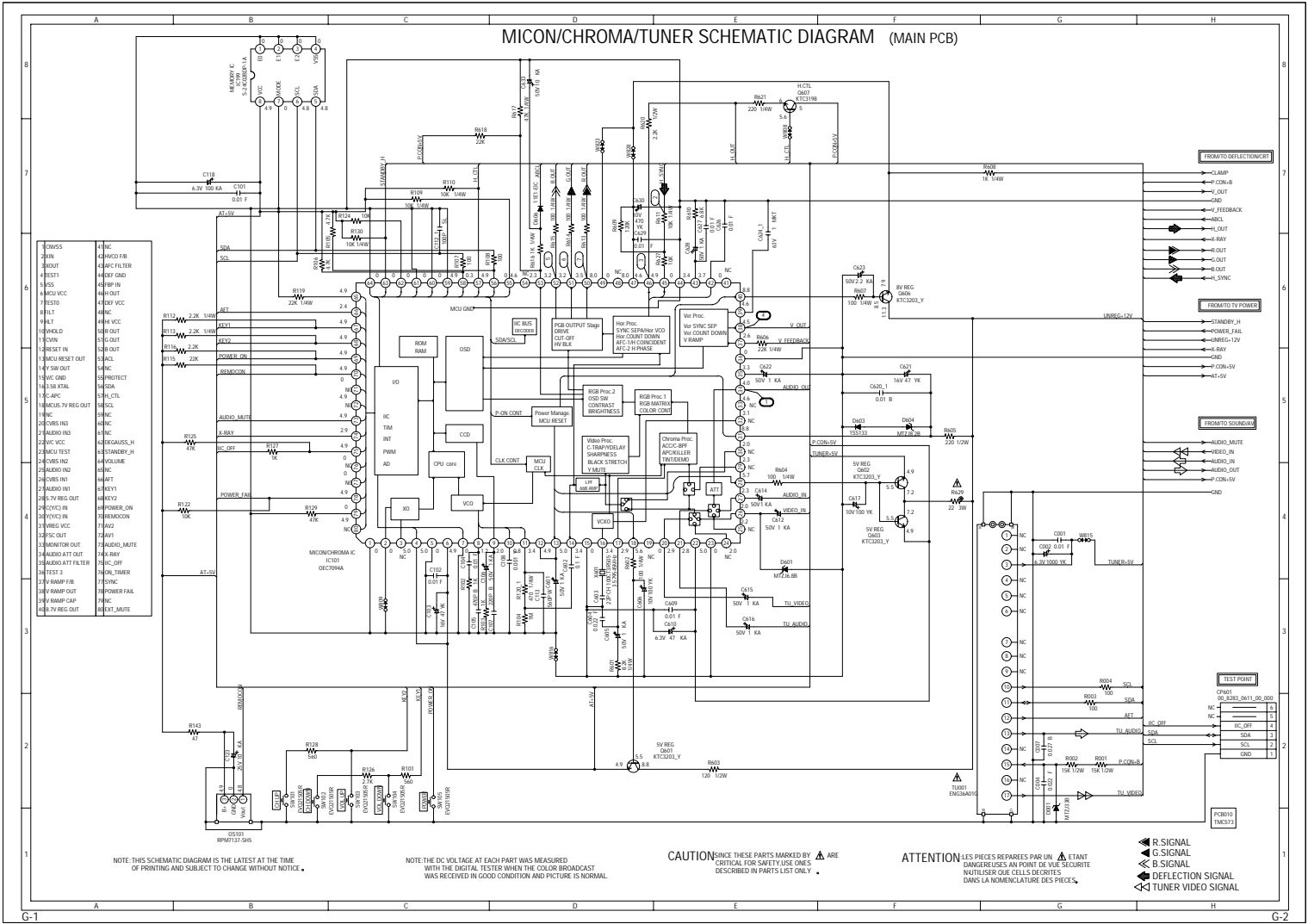


PRINTED CIRCUIT BOARDS  
MAIN/CRT (INSERTED PARTS)  
SOLDER SIDE





# MICON/CHROMA/TUNER SCHEMATIC DIAGRAM (MAIN PCB)



NOTE: THIS SCHEMATIC DIAGRAM IS THE LATEST AT THE TIME OF PRINTING AND SUBJECT TO CHANGE WITHOUT NOTICE.

NOTE: THE DC VOLTAGE AT EACH PART WAS MEASURED WITH THE DIGITAL TESTER WHEN THE COLOR BROADCAST WAS RECEIVED IN GOOD CONDITION AND PICTURE IS NORMAL.

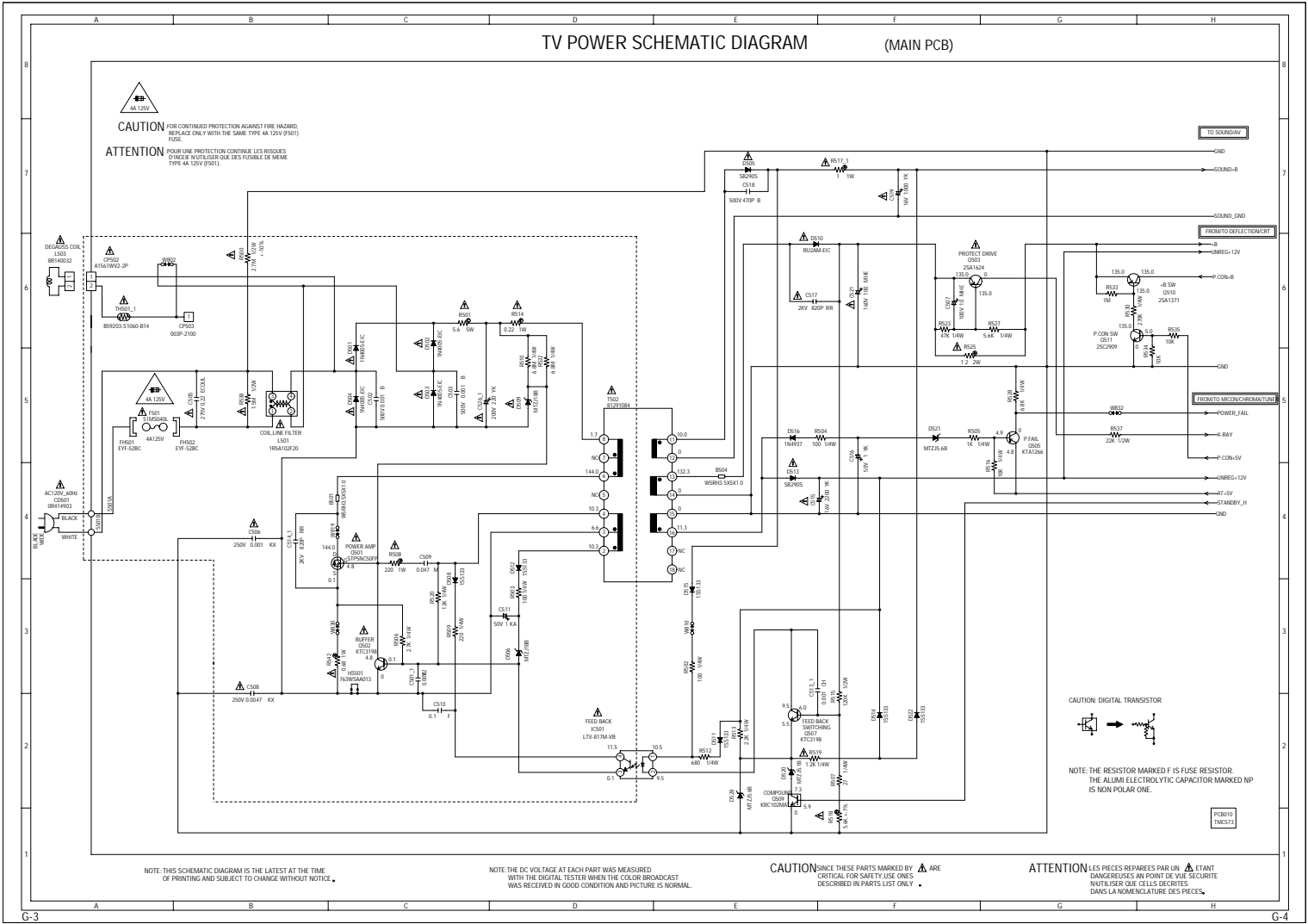
**CAUTION** SINCE THESE PARTS MARKED BY ARE CRITICAL FOR SAFETY, USE ONLY ONES DESCRIBED IN PARTS LIST ONLY.

**ATTENTION** LES PIÈCES RÉPARÉES PAR UN ÉTANT DANGEREUSES AU POINT DE VUE SÉCURITÉ, UTILISER SEULEMENT CELLES DÉCRITES DANS LA NOMENCLATURE DES PIÈCES.

- R. SIGNAL
- G. SIGNAL
- B. SIGNAL
- DEFLECTION SIGNAL
- TUNER VIDEO SIGNAL

# TV POWER SCHEMATIC DIAGRAM (MAIN PCB)

**CAUTION** FOR CONTINUED PROTECTION AGAINST FIRE HAZARD, REPLACE ONLY WITH THE SAME TYPE 4A 125V FUSE.  
**ATTENTION** POUR UNE PROTECTION CONTINUE LES RISQUES D'INCENDIE, REMPLACEZ SEULEMENT PAR UN FUSIBLE DE MÊME TYPE 4A 125V (F501).



NOTE: THIS SCHEMATIC DIAGRAM IS THE LATEST AT THE TIME OF PRINTING AND SUBJECT TO CHANGE WITHOUT NOTICE.

NOTE: THE DC VOLTAGE AT EACH PART WAS MEASURED WITH THE DIGITAL TESTER WHEN THE COLOR BROADCAST WAS RECEIVED IN GOOD CONDITION AND PICTURE IS NORMAL.

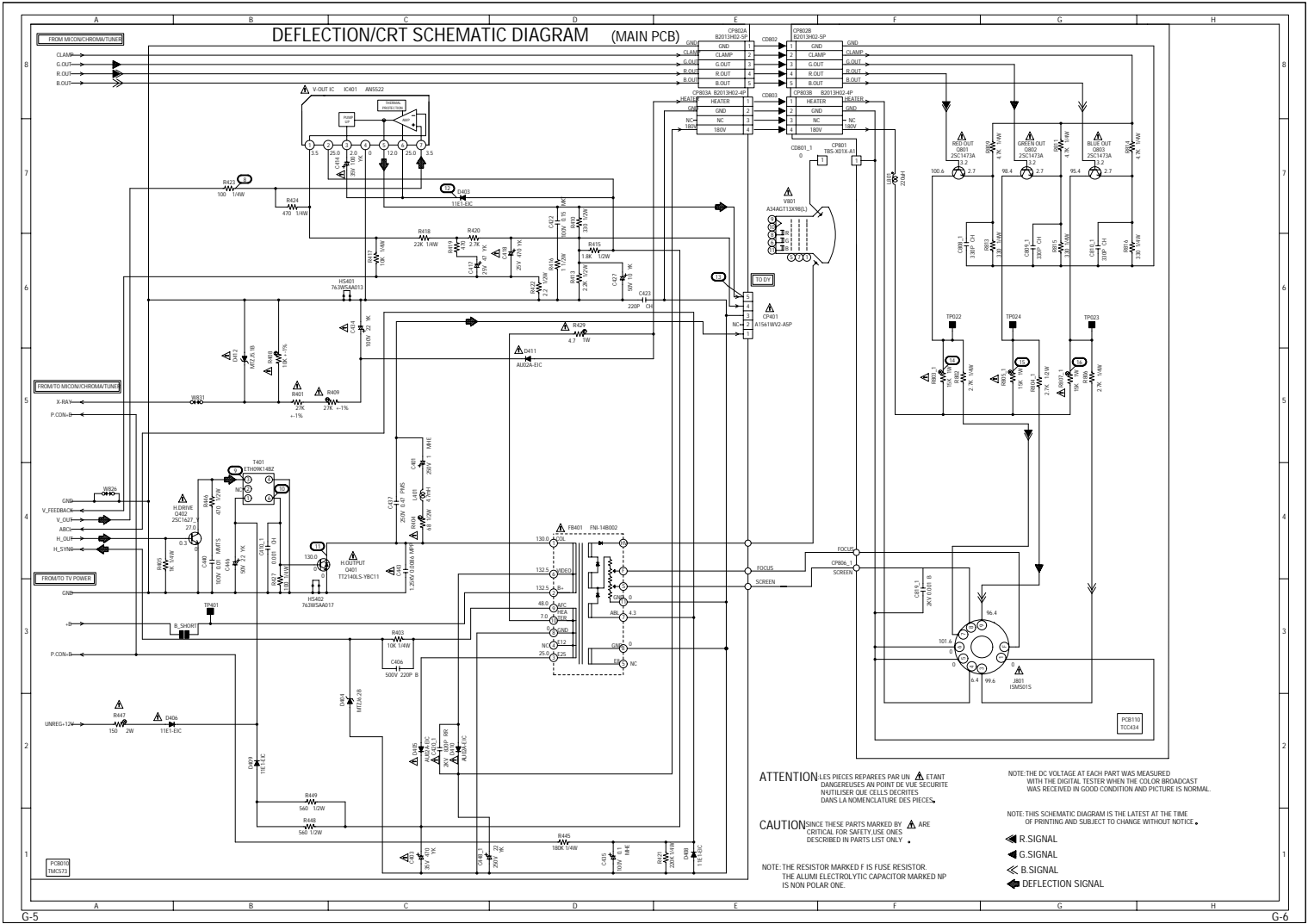
**CAUTION** SINCE THESE PARTS MARKED BY ARE CRITICAL FOR SAFETY USE ONES DESCRIBED IN PARTS LIST ONLY.

**ATTENTION** LES PIÈCES RÉPARÉES PAR UN ÉTANT DANGEREUSES AU POINT DE VUE SÉCURITÉ NUTILISER QUE CELLES DÉCRITES DANS LA NOMENCLATURE DES PIÈCES.

CAUTION DIGITAL TRANSISTOR

NOTE: THE RESISTOR MARKED F IS FUSE RESISTOR. THE ALUMI ELECTROLYTIC CAPACITOR MARKED NP IS NON POLAR ONE.

PCB010  
TM3371







# VOLTAGE LIST

## IC

IC101			
Pin	Volt.	Pin	Volt.
1	0	33	4.6
2	0	34	4
3	5	35	3.3
4	5	36	0
5	0	37	2.6
6	4.9	38	4.5
7	0	39	4.6
8	1.2	40	8.8
9	2	41	0
10	0.8	42	0
11	3.4	43	3.7
12	4.9	44	3.4
13	5	45	0
14	3.4	46	4.9
15	0	47	4.6
16	3.4	48	8
17	2.9	49	0
18	5.6	50	8
19	0	51	3.5
20	2.9	52	3.2
21	2.8	53	3.2
22	5	54	2.3
23	0	55	4.6
24	2	56	0
25	2.2	57	4.9
26	2	58	0.3
27	2.3	59	4.9
28	5.7	60	0
29	2.3	61	0
30	2	62	0
31	8.8	63	0
32	3.1	64	0

IC199	
Pin	Volt.
1	0
2	0
3	0
4	0
5	4.8
6	4.8
7	0
8	4.9

IC1001	
Pin	Volt.
1	3.9
2	0.3
3	0
4	5.1
5	8.2
6	3.5
7	0
8	3.4

IC401	
Pin	Volt.
1	3.5
2	25
3	2
4	0
5	12
6	25
7	3.5

IC501	
Pin	Volt.
1	10.5
2	9.5
3	0.1
4	11.5

## TRANSISTOR

Q401	
Pin	Volt.
B	0
C	130
E	0

Q402	
Pin	Volt.
B	0.3
C	27
E	0

Q501	
Pin	Volt.
G	4.8
S	0.1
D	144

Q502	
Pin	Volt.
B	0.1
C	4.8
E	0

Q503	
Pin	Volt.
B	135
C	0
E	135

Q505	
Pin	Volt.
B	4.9
C	0
E	4.8

Q506	
Pin	Volt.
B	0
C	0
E	0

Q507	
Pin	Volt.
B	6
C	9.5
E	5.5

Q509	
Pin	Volt.
B	5.9
C	7.3
E	0

Q510	
Pin	Volt.
B	135
C	135
E	135

Q511	
Pin	Volt.
B	5
C	135
E	0

Q601	
Pin	Volt.
B	5.5
C	8.8
E	4.9

Q602	
Pin	Volt.
B	5.5
C	7.2
E	4.9

Q603	
Pin	Volt.
B	5.5
C	7.2
E	4.9

Q606	
Pin	Volt.
B	8.5
C	11.3
E	7.9

Q607	
Pin	Volt.
B	5.6
C	5
E	6

Q801	
Pin	Volt.
B	3.2
C	100.6
E	2.7

Q802	
Pin	Volt.
B	3.2
C	98.4
E	2.7

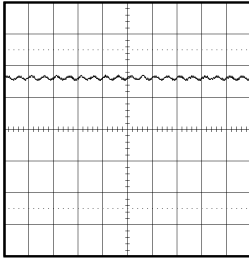
Q803	
Pin	Volt.
B	3.2
C	95.4
E	2.7

B ..... BASE  
 C ..... COLLECTOR  
 E ..... EMITTER

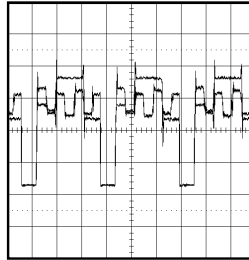
G ..... GATE  
 S ..... SOURCE  
 D ..... DRAIN

## WAVEFORMS

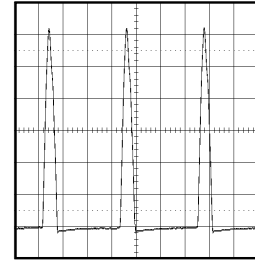
### MICON/CHROMA/TUNER



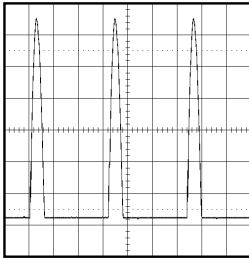
① 0.5V 2ms/div  
IC101 PIN 34(AUDIO OUT)



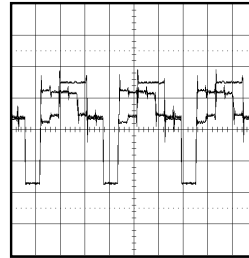
⑥ 1V 20 $\mu$ s/div  
IC101 PIN 51(G.OUT)



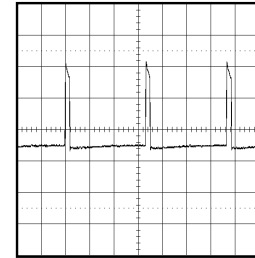
⑪ 200V 20 $\mu$ s/div  
Q401 Collector



② 20V 20 $\mu$ s/div  
R611

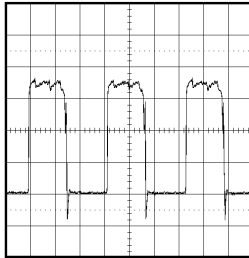


⑦ 1V 20 $\mu$ s/div  
IC101 PIN 50(R. OUT)

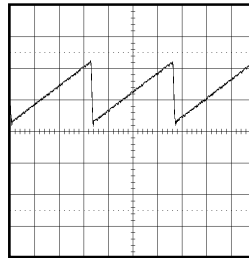


⑫ 10V 5ms/div  
D403

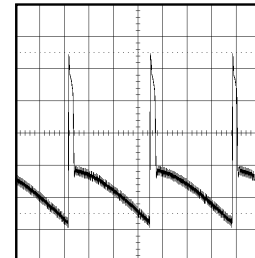
### DEFLECTION/CRT



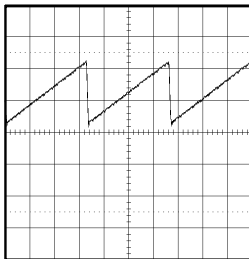
③ 200mV 20 $\mu$ s/div  
IC101 PIN 46(H.OUT)



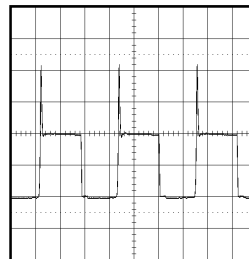
⑧ 0.5V 5ms/div  
R423



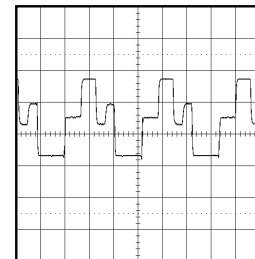
⑬ 10V 5ms/div  
CP401 PIN 5



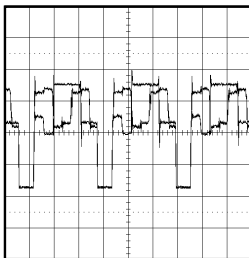
④ 0.5V 5ms/div  
IC101 PIN 38(V.OUT)



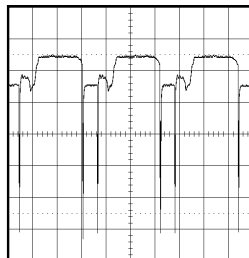
⑨ 20V 20 $\mu$ s/div  
T401 PIN 3



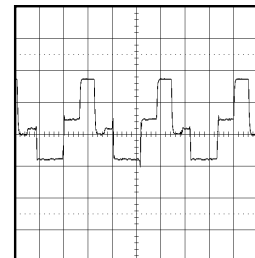
⑭ 50V 20 $\mu$ s/div  
R803



⑤ 1V 20 $\mu$ s/div  
IC101 PIN 52(B.OUT)



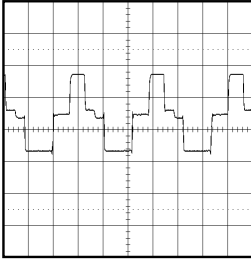
⑩ 2V 20 $\mu$ s/div  
T401 PIN 6



⑮ 50V 20 $\mu$ s/div  
R805

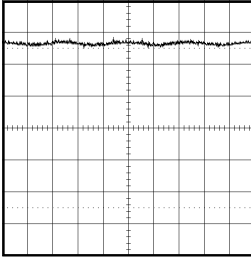
**NOTE:** The following waveforms were measured at the point of the corresponding balloon number in the schematic diagram.

## WAVEFORMS

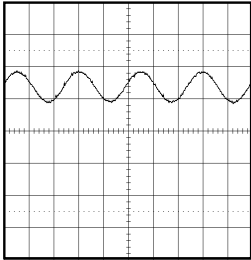


⑩ 50V 20 $\mu$ s/div  
R807

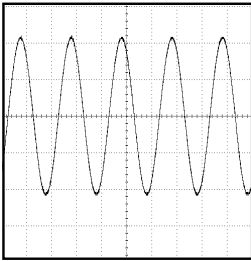
### SOUND/AV



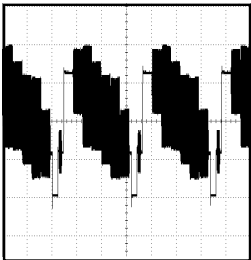
⑪ 0.5V 1ms/div  
C1001



⑫ 1V 1ms/div  
IC1001 PIN 6



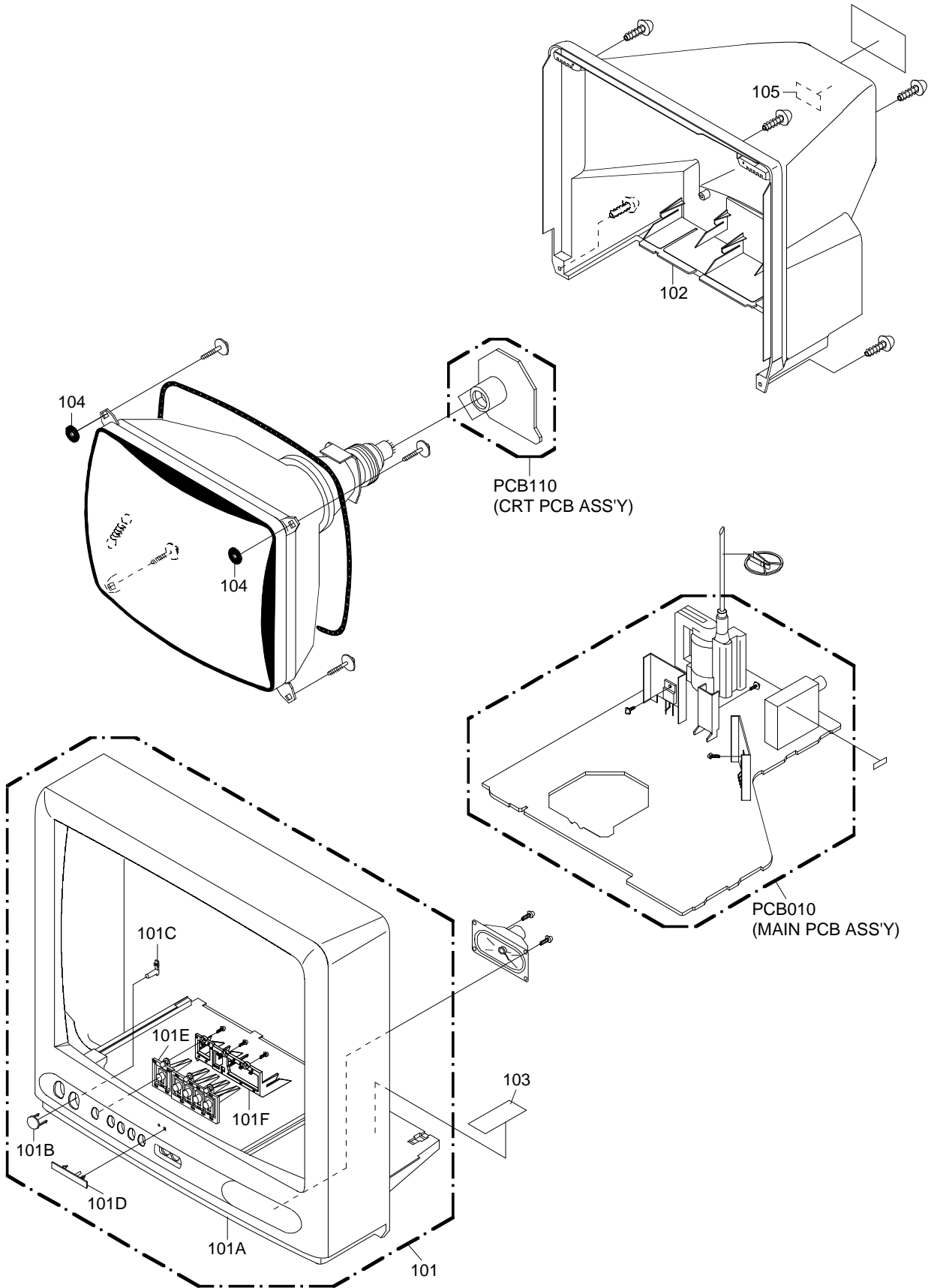
⑬ 200mV 500 $\mu$ s/div  
R703



⑭ 500mV 20 $\mu$ s/div  
R704

**NOTE:** The following waveforms were measured at the point of the corresponding balloon number in the schematic diagram.

# MECHANICAL EXPLODED VIEW



## MECHANICAL REPLACEMENT PARTS LIST

Location No.	Part No.	Description	Reference No.
101	702WPAA371	CABINET,FRONT ASSY (CT-13R18B)	
	702WPAA371	CABINET,FRONT ASSY (CT-13R38S)	
	702WPBA091	CABINET,FRONT ASSY (CT-13R28W)	
101A	701WPJC164	CABINET,FRONT (CT-13R18B)	
	701WPJC193	CABINET,FRONT (CT-13R38S)	
	701WPJC189	CABINET,FRONT (CT-13R28W)	
101B	711WPAA090	PLATE,FRONT	
101C	713WPAA095	GUIDE,REMOCON	
101D	723576A001	BADGE,BRAND (CT-13R18B)	
	723576A002	BADGE,BRAND (CT-13R38S, CT-13R28W)	
101E	735WPAA496	BUTTON,FRAME (CT-13R18B)	
	735WPAA494	BUTTON,FRAME (CT-13R38S)	
	735WPAA497	BUTTON,FRAME (CT-13R28W)	
101F	735WPAA498	BUTTON,BASE (CT-13R18B)	
	735WPAA495	BUTTON,BASE (CT-13R38S)	
	735WPAA499	BUTTON,BASE (CT-13R28W)	
102	702WPAA391	CABINET,BACK ASSY (CT-13R18B, CT-13R38S)	
	702WPBA091	CABINET,BACK (CT-13R28W)	
103	7230006755	SHEET,CAUTION	
104	800WR0A011	SHEET,CRT SUPPORT (D)	
105	726000A041	SHEET,CRT NO.	
---	724576A003	MODEL,NUMBER STICKER (CT-13R18B)	
	724576A004	MODEL,NUMBER STICKER (CT-13R38S)	
	724576A005	MODEL,NUMBER STICKER (CT-13R28W)	
---	TQB2AA0490	INSTRUCTION BOOK(E)	J3M11001A
---	TQB2AA0491	INSTRUCTION BOOK(S)	J3M11010A

## ELECTRICAL REPLACEMENT PARTS LIST

Location No.	Part No.	Description	Reference No.	Location No.	Part No.	Description	Reference No.
<b>RESISTORS</b>				<b>RESISTORS</b>			
R001	R002T2153J	RC 15K OHM 1/2W		R527	R002T4562J	RC 5.6K OHM 1/4W	
R002	R002T2153J	RC 15K OHM 1/2W		R528	R002T4682J	RC 6.8K OHM 1/4W	
R003	R801R7101J	RC 100 OHM 1/10W		R530	R002T4274J	RC 270K OHM 1/4W	
R004	R801R7101J	RC 100 OHM 1/10W		R533	R801R7105J	RC 1M OHM 1/10W	
R101	R801R7561J	RC 560 OHM 1/10W		R534	R801R7103J	RC 10K OHM 1/10W	
R102	R801R7102J	RC 1K OHM 1/10W		R535	R801R7103J	RC 10K OHM 1/10W	
R103	R801R7102J	RC 1K OHM 1/10W		R537	R002T2223J	RC 22K OHM 1/2W	
R104	R801R7105J	RC 1M OHM 1/10W		R538	R002T2155J	RC 1.5M OHM 1/2W	
R105	R801R7472J	RC 4.7K OHM 1/10W		△ R542	<b>R3X181R68J</b>	<b>R,METAL OXIDE 0.68 OHM 1W</b>	
R106	R801R7472J	RC 4.7K OHM 1/10W		R601	R002T4822J	RC 8.2K OHM 1/4W	
R107	R801R7101J	RC 100 OHM 1/10W		R602	R002T4101J	RC 100 OHM 1/4W	
R108	R801R7101J	RC 100 OHM 1/10W		R603	R002T2121J	RC 120 OHM 1/2W	
R109	R002T4103J	RC 10K OHM 1/4W		R604	R002T4101J	RC 100 OHM 1/4W	
R110	R002T4103J	RC 10K OHM 1/4W		R605	R002T2221J	RC 220 OHM 1/2W	
R112	R002T4222J	RC 2.2K OHM 1/4W		R606	R002T4223J	RC 22K OHM 1/4W	
R113	R002T4222J	RC 2.2K OHM 1/4W		R607	R002T4101J	RC 100 OHM 1/4W	
R115	R801R7223J	RC 22K OHM 1/10W		R608	R002T4102J	RC 1K OHM 1/4W	
R116	R801R7222J	RC 2.2K OHM 1/10W		R609	R801R7124J	RC 120K OHM 1/10W	
R119	R002T4223J	RC 22K OHM 1/4W		R610	R801R7682J	RC 6.8K OHM 1/10W	
R120	R002T4471J	RC 470 OHM 1/4W		R611	R002T4103J	RC 10K OHM 1/4W	
R122	R801R7103J	RC 10K OHM 1/10W		R613	R002T4101J	RC 100 OHM 1/4W	
R124	R801R7103J	RC 10K OHM 1/10W		R614	R002T4101J	RC 100 OHM 1/4W	
R125	R801R7473J	RC 47K OHM 1/10W		R615	R002T4101J	RC 100 OHM 1/4W	
R126	R801R7272J	RC 2.7K OHM 1/10W		R616	R002T4102J	RC 1K OHM 1/4W	
R127	R801R7102J	RC 1K OHM 1/10W		R617	R002T4473J	RC 47K OHM 1/4W	
R128	R801R7561J	RC 560 OHM 1/10W		R618	R801R7223J	RC 22K OHM 1/10W	
R129	R801R7473J	RC 47K OHM 1/10W		R620	R002T2222J	RC 2.2K OHM 1/2W	
R130	R002T4103J	RC 10K OHM 1/4W		R621	R002T4221J	RC 220 OHM 1/4W	
R143	R801R7470J	RC 47 OHM 1/10W		R627	R801R7103J	RC 10K OHM 1/10W	
△ R401	<b>R4X5T6273F</b>	<b>R,METAL 27K OHM 1/6W</b>		R629	R3X28B220J	R,METAL 22 OHM 3W	
R403	R002T4103J	RC 10K OHM 1/4W		R701	R002T4680J	RC 68 OHM 1/4W	
R404	R615U2680J	R,FUSE 68 OHM 1/2W		R702	R801R7473J	RC 47K OHM 1/10W	
R405	R002T4102J	RC 1K OHM 1/4W		R703	R801R7821J	RC 820 OHM 1/10W	
△ R408	<b>R4X5T6103F</b>	<b>R,METAL 10K OHM 1/6W</b>		R704	R801R7100J	RC 10 OHM 1/10W	
△ R409	<b>R4X5T6273F</b>	<b>R,METAL 27K OHM 1/6W</b>		R802	R002T4272J	RC 2.7K OHM 1/4W	
R410	R002T2331J	RC 330 OHM 1/2W		△ R803	<b>R3X181153J</b>	<b>R,METAL OXIDE 15K OHM 1W</b>	
R413	R002T2222J	RC 2.2K OHM 1/2W		R804	R002T2272J	RC 2.7K OHM 1/2W	
R415	R002T2182J	RC 1.8K OHM 1/2W		△ R805	<b>R3X181153J</b>	<b>R,METAL OXIDE 15K OHM 1W</b>	
R416	R002T2010J	RC 1 OHM 1/2W		R806	R002T4272J	RC 2.7K OHM 1/4W	
R417	R002T4103J	RC 10K OHM 1/4W		△ R807	<b>R3X181153J</b>	<b>R,METAL OXIDE 15K OHM 1W</b>	
R418	R002T4223J	RC 2.2K OHM 1/4W		R809	R002T4472J	RC 4.7K OHM 1/4W	
R419	R801R7471J	RC 470 OHM 1/10W		R811	R002T4472J	RC 4.7K OHM 1/4W	
R420	R801R7272J	RC 2.7K OHM 1/10W		R813	R002T4331J	RC 330 OHM 1/4W	
R421	R002T4224J	RC 220K OHM 1/4W		R814	R002T4472J	RC 4.7K OHM 1/4W	
R422	R002T22R2J	RC 2.2 OHM 1/2W		R815	R002T4331J	RC 330 OHM 1/4W	
R423	R002T4101J	RC 100 OHM 1/4W		R816	R002T4331J	RC 330 OHM 1/4W	
R424	R002T4471J	RC 470 OHM 1/4W		R1001	R002T4473J	RC 47K OHM 1/4W	
R427	R002T4101J	RC 100 OHM 1/4W		R1003	R801R7683J	RC 68K OHM 1/10W	
△ R429	<b>R635814R7J</b>	<b>R,FUSE 4.7 OHM 1W</b>		R1004	R801R7104J	RC 100K OHM 1/10W	
R445	R002T4184J	RC 180K OHM 1/4W		R1005	R801R7274J	RC 270K OHM 1/10W	
R446	R002T2471J	RC 470 OHM 1/2W		R1007	R002T2470J	RC 47 OHM 1/2W	
R447	R3X28A151J	R,METAL OXIDE 150 OHM 2W		R1008	R801R7393J	RC 39K OHM 1/10W	
R448	R002T2561J	RC 560 OHM 1/2W		<b>CAPACITORS</b>			
R449	R002T2561J	RC 560 OHM 1/2W		C001	ECUV1H1032ZFG	CC 0.01 UF 50V F	
△ R500	<b>R0G3K2275K</b>	<b>RC 2.7M OHM 1/2W</b>		C002	E02LT0102M	CE 1000 UF 6.3V	CS0RF0414Z
△ R501	<b>RSY2CD5R6J</b>	<b>R,CEMENT 5.6 OHM 5W</b>		C004	CQGTFO4H4Z	CC 0.022 UF 50V F	
R502	R002T4101J	RC 100 OHM 1/4W		C007	CQGTB04H4K	CC 0.022 UF 50V B	
R503	R002T4101J	RC 100 OHM 1/4W		C101	ECUV1H1032ZFG	CC 0.01 UF 50V F	CS0RF0414Z
R504	R002T4101J	RC 100 OHM 1/4W		C102	ECUV1H1032ZFG	CC 0.01 UF 50V F	CS0RF0414Z
R505	R002T4102J	RC 1K OHM 1/4W		C103	E02LU2470M	CE 47 UF 16V	
R506	R002T4272J	RC 2.7K OHM 1/4W		C104	ECUV1H1032ZFG	CC 0.01 UF 50V F	CS0RF0414Z
R507	R002T4270J	RC 27 OHM 1/4W		C105	ECUV1H471KBN	CC 470 PF 50V B	CS0RB04Q2K
△ R508	<b>R3X181221J</b>	<b>R,METAL OXIDE 220 OHM 1W</b>		C106	E50HU5010M	CE 1 UF 50V	
△ R509	<b>R002T4221J</b>	<b>RC 220 OHM 1/4W</b>		C107	ECUV1H221KBN	CC 220 PF 50V B	CS0RB04H2K
R510	R002T4685J	RC 6.8M OHM 1/4W		C108	ECUV1H102KBN	CC 0.001 UF 50V B	CS0RB0413K
R512	R002T4681J	RC 680 OHM 1/4W		C112	ECUV1H101JCG	CC 100 PF 50V CH	CS0RCH412J
R513	R002T4222J	RC 2.2K OHM 1/4W		C113	ECUV1H561KBN	CC 560 PF 50V B	CS0RB04S2K
△ R514	<b>R63581R22J</b>	<b>R,FUSE 0.22 OHM 1W</b>		C118	E50HU0101M	CE 100 UF 6.3V	
△ R515	<b>R002T2124J</b>	<b>RC 120K OHM 1/2W</b>		C123	E50HU3100M	CE 10 UF 25V	
R516	R002T4103J	RC 10K OHM 1/4W		C401	E5EZTD010M	CE 1 UF 250V	
△ R517	<b>R3X181010J</b>	<b>R,METAL OXIDE 1 OHM 1W</b>		△ C403	<b>E02LT4471M</b>	<b>CE 470 UF 35V</b>	
△ R518	<b>R4X5T6562F</b>	<b>R,METAL 5.6K OHM 1/6W</b>		C406	C0JTB05H2K	CC 220 PF 500V B	
△ R519	<b>R002T4122J</b>	<b>RC 1.2K OHM 1/4W</b>		C410	CQGTCH413J	CC 0.001 UF 50V CH	
R520	R002T4123J	RC 12K OHM 1/4W		△ C414	<b>E02LU4101M</b>	<b>CE 100 UF 35V</b>	
R522	R002T4685J	RC 6.8M OHM 1/4W		C417	E02LU3470M	CE 47 UF 25V	
R523	R002T4473J	RC 47K OHM 1/4W		△ C418	<b>E02LT3471M</b>	<b>CE 470 UF 25V</b>	
R525	R3X18A1R2J	R,METAL OXIDE 1.2 OHM 2W		C420	C0PLRR7W2K	CC 820 PF 2KV R	

# ELECTRICAL REPLACEMENT PARTS LIST

Location No.	Part No.	Description	Reference No.	Location No.	Part No.	Description	Reference No.	
<b>CAPACITORS</b>				<b>DIODES</b>				
C422	P235W1154J	CMP 0.15 UF 100V MKT		D603	D1VT001330	DIODE,SILICON 1SS133T-77	D97U08R21B	
C423	CQGTCH4H2J	CC 220 PF 50V CH		D604	MTZJ8.2BT-77	DIODE,ZENER MTZJ8.2B T-77		
C427	E02LU5100M	CE 10 UF 50V		D606	D2WTO11E10	DIODE,SILICON 11E1-EIC		
C434	E02LU8220M	CE 22 UF 100V		D701	D97U06R81B	DIODE,ZENER MTZJ8.8B T-77		
C435	E5EZT80R1M	CE 0.1 UF 100V		<b>ICS</b>				
C437	P4J7F3474J	CMPP 0.47 UF 250V PMS		IC101	I56F07094A	IC OEC7094A		
C440	P232W1103J	CMP 0.01 UF 100V MMTS		IC199	A3M110A015	IC S-24C02BDP-1A		
△ C443	P4N8FJ862H	CMPP 0.0086UF 1.25KV		△ IC401	I01TD55220	IC AN5522		
△ C446	E02LU5220M	CE 22 UF 50V		IC501	0002E00610	PHOTO COUPLER LTV-817M-VB		
△ C448	E0ELFD220M	CC 22 UF 250V		IC1001	I01DP75110	IC AN7511		
C501	CS0RB04W3K	CC 0.0082UF 50V B		<b>TRANSISTORS</b>				
C502	C0JTB0513K	CC 0.001 UF 500V B		△ Q401	TD3Q021400	TRANSISTOR,SILICON TT2140LS-YBC11		
△ C503	C0JTB0513K	CC 0.001 UF 500V B		△ Q402	TC5T01627Y	TRANSISTOR,SILICON 2SC1627_Y(TPE2)		
△ C505	P2122B224M	CMP 0.22 UF 275V ECQUL		△ Q501	TJXG5NC500	FET STP5NC50FP		
C506	CD39E0M13M	CC 0.001 UF 250V		△ Q502	TCATC31980	TRANSISTOR,SILICON KTC3198-AT(Y,GR)		
C507	E5EZT8100M	CE 10 UF 100V		Q503	TA3T016240	TRANSISTOR,SILICON 2SA1624-AA		
C508	CD39E0MQ3M	CC 0.0047UF 250V		Q505	TAATA12660	TRANSISTOR,SILICON KTA1266-AT(Y,GR)		
C509	P1F4T0473J	CP 0.047 UF 50V		Q507	TCATC31980	TRANSISTOR,SILICON KTC3198-AT(Y,GR)		
C510	CQGTFO415Z	CC 0.1 UF 50V F		Q509	TNATB03005	COMPOUND TRANSISTOR KRC102MAT		
C511	E50HU5010M	CE 1 UF 50V		Q510	TA3T1371A0	TRANSISTOR,SILICON 2SA1371(D,E)-AE		
C513	CQGTCH413J	CC 0.001 UF 50V CH		Q511	TC3T029090	TRANSISTOR,SILICON 2SC2909(S,T)-AA		
C514	C0PLRR7W2K	CC 820 PF 2KV R		Q601	TCAT032034	TRANSISTOR,SILICON KTC3203_Y-AT		
△ C515	E02L02222M	CE 2200 UF 16V		Q602	TCAT032034	TRANSISTOR,SILICON KTC3203_Y-AT		
C516	E02LU5010M	CE 1 UF 50V		Q603	TCAT032034	TRANSISTOR,SILICON KTC3203_Y-AT		
C517	C0PLRR7W2K	CC 820 PF 2KV R		Q606	TCAT032034	TRANSISTOR,SILICON KTC3203_Y-AT		
C518	C0JTB05Q2K	CC 470 PF 500V B		Q607	TCATC31980	TRANSISTOR,SILICON KTC3198-AT(Y,GR)		
△ C519	E02LT2102M	CE 1000 UF 16V		△ Q801	2SC1473ATA	TRANSISTOR,SILICON 2SC1473A-TA-(RQ)		
C521	E5EZF8101M	CE 100 UF 160V		△ Q802	2SC1473ATA	TRANSISTOR,SILICON 2SC1473A-TA-(RQ)		
△ C528	E02LFC221M	CE 220 UF 200V		△ Q803	2SC1473ATA	TRANSISTOR,SILICON 2SC1473A-TA-(RQ)		
C601	E50HU5010M	CE 1 UF 50V		<b>COILS &amp; TRANSFORMERS</b>				
C602	CQGTFO415Z	CC 0.1 UF 50V F		L401	021L75472J	COIL 4.7 MH		
C603	ECUV1H220JC	CC 22 PF 50V CH	CS0RCH4H1J	△ L501	029T00A7M1	COIL, LINE FILTER 1R5A102F20		
C604	ECUV1H223ZF	CC 0.022 UF 50V F	CS0RF04H4Z	△ L503	028R140032	COIL, DEGAUSS 8R140032		
C605	E50HU5010M	CE 1 UF 50V		L801	021673221K	COIL 220 UH		
C606	E02LU1101M	CE 100 UF 10V		T401	045009003J	TRANS,HORIZONTAL DRIVE ETH09K14BZ		
C609	ECUV1H1032F	CC 0.01 UF 50V F	CS0RF0414Z	△ T502	0481291084	TRANSFORMER,SWITCHING 81291084		
C610	E50HU0470M	CE 47 UF 6.3V		<b>JACKS</b>				
C612	E50HU5010M	CE 1 UF 50V		J702	060Q401077	RCA JACK AV1-09D-3		
C614	E50HU5010M	CE 1 UF 50V		J703	060Q401076	RCA JACK AV1-09D-4		
C615	E50HU5010M	CE 1 UF 50V		△ J801	066F120018	SOCKET,CATHODE RAY TUBE ISMS01S		
C616	E50HU5010M	CE 1 UF 50V		J1001	060J121014	JACK,RCA 3.5 MSJ-035-12A_PC		
C617	E02LU1101M	CE 100 UF 10V		<b>SWITCHES</b>				
C620	CQGTB0414K	CC 0.01 UF 50V B		SW101	0504101134	SWITCH,TACT EVQ21505R		
C621	E02LU2470M	CE 47 UF 16V		SW102	0504101134	SWITCH,TACT EVQ21505R		
C622	E50HU5010M	CE 1 UF 50V		SW103	0504101134	SWITCH,TACT EVQ21505R		
C623	E50HU52R2M	CE 2.2 UF 50V		SW104	0504101134	SWITCH,TACT EVQ21505R		
C624	P235WE105J	CMP 1 UF 63V MKT		SW105	0504101134	SWITCH,TACT EVQ21505R		
C626	ECUV1H1032F	CC 0.01 UF 50V F	CS0RF0414Z	<b>P.C. BOARD ASSEMBLIES</b>				
C627	ECUV1H1032F	CC 0.01 UF 50V F	CS0RF0414Z	PCB010	A3M110G010	PCB ASS'Y TMC573A		
C628	E50HU5010M	CE 1 UF 50V		PCB110	A3M110G110	PCB ASS'Y TCC434A		
C629	ECUV1H1032F	CC 0.01 UF 50V F	CS0RF0414Z	<b>MISCELLANEOUS</b>				
C630	E02LU1471M	CE 470 UF 10V		ANT001	125C104001	ANTENNA,10D HPAS-2S400		
C633	E50HU5100M	CE 10 UF 50V		B501	024HT03553	CORE,BEADS W5RH3.5X5X1.0		
C808	CQGTCH4L2J	CC 330 PF 50V CH		B504	024HT03553	CORE,BEADS W5RH3.5X5X1.0		
C809	CQGTCH4L2J	CC 330 PF 50V CH		△ CD501	120R414903	CORD,AC BUSH 0R414903		
C810	CQGTCH4L2J	CC 330 PF 50V CH		△ CP401	069S450089	CONNECTOR PCB SIDE A1561WV2-A5P		
C819	C0JBB0713K	CC 0.001 UF 2KV B		△ CP502	069S420110	CONNECTOR PCB SIDE A1561WV2-2P		
C1001	E50HU50R1M	CE 0.1 UF 50V		CP503	069W01001A	CONNECTOR PCB SIDE 003P-2100		
C1003	E50HU5010M	CE 1 UF 50V		CP601	069E260659	CONNECTOR PCB SIDE 00_8283_0611_00_000		
C1004	ECUV1H152KB	CC 0.0033UF 50V B	CS0RB04L3K	CP801	069W010030	CONNECTOR PCB SIDE TBS-X01X-A1		
C1005	E50HU3100M	CE 10 UF 25V		CD101A	06CH013202	CORD,CONNECTOR CH013202		
C1006	E00NU2470M	CE 47 UF 16V		CD101B	06CH013203	CORD,CONNECTOR CH013203		
<b>DIODES</b>				<b>RESISTOR</b>				
D001	D97U03301B	DIODE,ZENER MTZJ33B T-77		RC.....		CARBON RESISTOR		
D403	D2WTO11E10	DIODE,SILICON 11E1-EIC		<b>CAPACITORS</b>				
D404	MTZJ6.2BT-77	DIODE,ZENER MTZJ6.2B T-77	D97U06R21B	CC.....	CERAMIC CAPACITOR			
△ D405	D2WTAU02A0	DIODE,SILICON AU02A-EIC		CE.....	ALUMI ELECTROLYTIC CAPACITOR			
D406	D2WTO11E10	DIODE,SILICON 11E1-EIC		CP.....	POLYESTER CAPACITOR			
D408	D2WTO11E10	DIODE,SILICON 11E1-EIC		CPP.....	POLYPROPYLENE CAPACITOR			
D409	D2WTO11E10	DIODE,SILICON 11E1-EIC		CPL.....	PLASTIC CAPACITOR			
△ D410	D2WTAU02A0	DIODE,SILICON AU02A-EIC		CMP.....	METAL POLYESTER CAPACITOR			
D411	D2WTAU02A0	DIODE,SILICON AU02A-EIC		CMPL.....	METAL PLASTIC CAPACITOR			
△ D412	MTZJ5.1BT-77	DIODE,ZENER MTZJ5.1B T-77	D97U05R11B	CMPP.....	METAL POLYPROPYLENE CAPACITOR			
D501	D2WXN40050	DIODE,SILICON 1N4005-EIC		<b>RESISTOR</b>				
△ D502	D2WXN40050	DIODE,SILICON 1N4005-EIC		RC.....		CARBON RESISTOR		
△ D503	D2WXN40050	DIODE,SILICON 1N4005-EIC		<b>CAPACITORS</b>				
D504	D2WXN40050	DIODE,SILICON 1N4005-EIC		CC.....	CERAMIC CAPACITOR			
△ D505	D2WXB290S0	DIODE,SILICON SB290S		CE.....	ALUMI ELECTROLYTIC CAPACITOR			
D506	D97U01801B	DIODE,ZENER MTZJ18B T-77		CP.....	POLYESTER CAPACITOR			
D508	D1VT001330	DIODE,SILICON 1SS133T-77		CPP.....	POLYPROPYLENE CAPACITOR			
△ D509	D97U01801B	DIODE,ZENER MTZJ18B T-77		CPL.....	PLASTIC CAPACITOR			
△ D510	D2WXR2AM0	DIODE,SILICON RU2AM-EIC		CMP.....	METAL POLYESTER CAPACITOR			
D511	D1VT001330	DIODE,SILICON 1SS133T-77		CMPL.....	METAL PLASTIC CAPACITOR			
△ D512	1SS133T-77	DIODE,SILICON 1SS133T-77		CMPP.....	METAL POLYPROPYLENE CAPACITOR			
D513	D2WXB290S0	DIODE,SILICON SB290S		<b>RESISTOR</b>				
D514	D1VT001330	DIODE,SILICON 1SS133T-77		RC.....		CARBON RESISTOR		
D515	D1VT001330	DIODE,SILICON 1SS133T-77		<b>CAPACITORS</b>				
△ D516	D2WXN49370	DIODE,SILICON 1N4937		CC.....	CERAMIC CAPACITOR			
D520	MTZJ5.1BT-77	DIODE,ZENER MTZJ5.1B T-77	D97U05R11B	CE.....	ALUMI ELECTROLYTIC CAPACITOR			
D521	D97U05R61B	DIODE,ZENER MTZJ5.6B T-77		CP.....	POLYESTER CAPACITOR			
D522	D1VT001330	DIODE,SILICON 1SS133T-77		CPP.....	POLYPROPYLENE CAPACITOR			
D528	D97U05R61B	DIODE,ZENER MTZJ5.6B T-77		CPL.....	PLASTIC CAPACITOR			
D601	D97U06R81B	DIODE,ZENER MTZJ6.8B T-77		CMP.....	METAL POLYESTER CAPACITOR			



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